# Modified Yoyo Model and Its Applications in Chinese History

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**Abstract**

This paper focuses on the modified yoyo model, a hot issue of the system research called the second dimension of science, and it supplies a new theory and methodology to address and solve the practical problems, which have been extremely difficult in modern science. Moreover, the new explanations of the Chinese history about the periods of Spring and Autumn and the Warring States are introduced by the modified yoyo model.

The systemic yoyo model is a new tool to describe the general systems, and it is effective to explain the existing phenomenon. The modified yoyo model, based on the systemic yoyo model, is constructed by the forms of the definitions and laws, which are demonstrated and explained by lots of the existing system theories and practical examples. The application of this model in Chinese history is a new look at the historical events, compared with the traditional study of the Chinese history.

The modified yoyo model is proposed based on the systemic yoyo model and it emphasizes on explaining some theoretic problems of the system model, such as the general system structure model, system's characteristics, systems' interaction and so on. Firstly, the yoyo model can not sufficiently depict the attributes of the general system, such as the behavior, the function, the size of the system and so on. All of these are the indispensability of a system and the system is half-baked without them. Secondly, the basic characters of the yoyo model are not given enough to describe the system roundly. These matters include the complexity, diversity, stability of the system and how the system comes into being or perdition. Thirdly, there have been many examples that refer to the interaction between yoyos, but the interaction process is not detailedly discussed and the final result can be ascertained by some laws. The modified yoyo model is applied in the Chinese history about the Spring and Autumn and Warring States Periods. The military system of each country in the ancient time is modeled by the modified yoyo model and their interactions are analyzed by the characters of the modified yoyo, which lead to the same results with the history.

The modified yoyo model is firstly applied in the Chinese history, and the battle effectiveness of the military system is modeled as a yoyo. The wars between the countries are described as the interaction of the modified yoyos, and the rea-

sonable results of the wars are also explained. In fact, since the general systems are modeled by the modified yoyo model, this model can be applied in many practical systems, such as three-body movement system, economic system and so on.

In theory, the modified yoyo model embodies and develops the systemic yoyo model, and it introduces some new concepts and characters of the yoyo as well as their interaction, which can be effectively used for the general system analysis. When referring to the application, the modified yoyo model can explain or predict lots of phenomenon, which may be the puzzles in modern science.
**Keywords** Modified yoyo model, Yoyo's character, Yoyos' interaction, Spring and Autumn and Warring States, Military system

## 1 Introduction

As the developments of the system science and system thinking, new theories and methodologies have brought new understandings and discoveries to some of the major unsettled problems in modern science. Moreover, the view of wholeness and interconnectedness in system thinking has greatly changed the tendency of modern science, such as synthesizing all areas of knowledge into a few major blocks, the appearance of the second dimension science and the cross-disciplinary studies, etc.

System is not only an entity that can be touched and felt actually but also a thinking that is used to observe the world around us. Then we would have a new idea to find the potential connection and disciplines that have been ignored for the divide of modern science. In fact, lots of so-called puzzles are caused by this parochialism. Therefore, it is reasonable that these puzzles may be solved easily by system thinking, which causes the development of system science inversely. The yoyo model[1], cared and developed by Yi Lin, is a useful systemic tool to describe the real world and nearly all kinds of phenomenon, and it stands for the freshest achievement of system science.

However, the renascence of yoyo model causes its imperfectness in theory and application. Many entities and phenomenon have been modeled by the yoyo model soundly, but most of the basic properties of the system are not explained precisely, leading to an uncertain result. So this paper focuses on modifying the yoyo model and applying it in Chinese history of the periods of Spring and Autumn and Warring States.

### *1.1 A History Review of System and the Origin of Yoyo Model*

Systems methodology is an important concept in system science, and it is understood in different ways by scholars at different periods and different science fields. However, the understandings are roughly the same and they are unified together gradually. Quastler[2] said: "systems methodology is essentially the es-

tablishment of a structural foundation for four kinds of theories of organization". The opinion of Zadeh[3] is that the main task of systems science is the study of general properties of systems without considering their physical specifics. Even though the concept of systems has been a hot spot of discussion in almost all areas of modern science and technology, which was first introduced formally by von Bertalanffy[4] in the second decade of the 20th century in biology, as all new concepts in science, the ideas and thinking logic of systems have a long history.

Although the concept of system is not emphasized in history, its idea was proposed thousands of years ago and "The whole is greater than the parts" is good evidence. During most time of the science history, the first dimension method has played a leading role in scientific research. As time going by, system attracted more and more attentions for the conflicts from the isolation of subjects and lots of new characters of system, such as the wholeness, interconnection, and occlusion, have been proposed in different fields. In last century, there have been many advances in technology: energies produced by various devices such as steam engines, motors, computers and automatic controllers, self-controlled equipment from domestic temperature controllers to self-directed missiles, and the information highway that has resulted in increased communication of new scientific results. All of these made the system a individual subject, and some scholars began to research the system from many points of view. The concept of the second dimension gradually came to the view, and system science came to a new level.

At the turn of 21st century, with his profound insights, independent creativity, and courage, Shoucheng OuYang proposed the blown-up theory of nonlinear evolution problems[5]. Uneven structures are eddy sources, leading to eddy motions instead of waves, the mystery of nonlinearity, which has been bothering humankind for long time, is resolved at once both physically and mathematically. On the basis of the blown-up theory, the concepts of black holes, Big Bangs, and converging and diverging eddy motions are coined together in the model shown in Fig.1[6].

Each system or object considered in a study is a multidimensional entity that spins about its invisible axis. If such a spinning entity is fathomed in three-dimensional space, a structure like that shown in Fig.1 would be achieved. For the sake of convenience of communication, such a structure is called a yoyo due to its general shape. More specifically, what this model says is that each physical entity in the universe, be it a tangible or intangible object, a living being, an organization, a culture, a civilization, etc., can be seen as a kind of realization of a certain multidimensional spinning yoyo with an invisible spin field around it. It stays in a constant spinning motion. If it does stop spinning, it will no longer exist as an identifiable system.

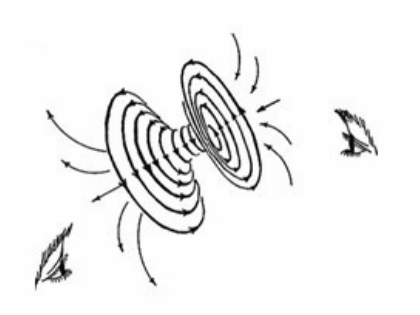

**Fig.1** Yoyo Model

(The side of a black hole sucks in all things, such as materials, information, energy, etc. After funneling through the short narrow neck, all things are spit out in the form of a Big Bang. Some of the materials, spit out from the end of the Big Bang, never return to the other side, and some will.)

*1.2 Wide Applications of Yoyo Model*

Because spin is the fundamental evolutionary feature and characteristic of materials, the yoyo model can be used in figurative analysis method. It also gives us a chance to generalize all three laws of motion so that external forces are no longer required for these laws to work[7]. In terms of applications of the yoyo model in social science and humanity areas, it is shown that in a market of free competition, a concept as fundamental as demand and supply is about mutual reactions and mutual restrictions of different forces under equal quantitative effects[7]. Hence, each economic entity can be naturally modeled and simulated as an economic yoyo or a flow of such yoyos. When looking at how people think, one can show the existence of the systemic yoyo structure in human thoughts[7]. So, the human way of thinking is proven to have the same structure as that of the material world. In a word, what can be thought as a system, what can be considered as a yoyo model.

Why does the yoyo model have so wide applications in our world? The most important is that it captures the essential character, i.e. nonlinearity and unevenness, of the general systems, and scientifically abstracts the main conflict between problems. The yoyo model describes the uneven resources, so it also describes the nonlinear motion since the motion comes from the uneven resources. The second reason lies in the materialism, which implies that the world is made up of materials. No one can talk anything without the materials, including the yoyo model. The yoyo model firstly pays attention on the materials, the basis of general system, and then has the ability to uncover the disciplines of much phenomenon about the materials. Moreover, the yoyo model, proposed and developed by lots greats, has a unique structure that is fit to all kinds of real systems. All of these

make the yoyo model have a leading role in system research.

### *1.3 The Imperfection of Yoyo Model*

As what's known, the yoyo model has attracted more and more attentions since its appearance. This depends on its wide applications in our lives; however, due to the renascence of the yoyo model, it has some imperfections that need to be developed. There have been many examples that the yoyo model can explain partly, which show that the yoyo model is correct to describe our world; on the other hand, it can not give us a clear sense about the systems, their basic characters and their interactions. So we need to consummate the yoyo model to give a perfect explanation about the general system.

Fig.1 has gives us a direct vision about the yoyo model, which stands for any objects that can be considered as a real system. However, when a system is modeled as a yoyo, we could not know the basic information about the yoyo model, such as its exact shape, height, its spin direction, etc. In any case, we only know that the yoyo model exists with a system, and all the things, such as the materials, information and energy, come into the yoyo from the black hole and come out from the big bang. How shall we measure the stability of the yoyo? How does the yoyo spin? What is the yoyo's size? Nobody knows. If the yoyo model and its basic attributes are strictly defined, all of the puzzles above would be solved easily.

Moreover, the characters of the yoyo, such as the complexity and the diversity, should be explained by the yoyo model. Firstly, the behavior of the yoyo is not paid enough attentions, because there are lots of cases that we can not capture the yoyo directly, but the behavior of the system is easy to learn, by which we can conclude the system indirectly, i.e. the yoyo and its behavior have some equivalences. Secondly, the characters of the yoyo can tell us how a new yoyo comes into being, how an old yoyo is destroyed and how the yoyo keeps its steady structure. Therefore, the characters of the yoyo should be studied carefully before its applications.

Another problem is the interaction between yoyos. As explained in examples, the interaction between yoyos is complex and the yoyos always release a 'force' to each others, so the phenomenon of the birth, the development and the perdition of yoyos occur during the interaction. For example, the competition between two yoyos, standing for two companies, will cause the bankruptcy of the weaker or their contemporary existence, but how shall we know which would happen? What we have finished only is that both of them can be explained by yoyo model and their interaction leads to two results. Therefore, the interaction between yoyos should be analyzed more precisely and interaction disciplines should be uncovered. Then based on the interaction laws, we can easily predict what will happen after the interaction between yoyos.

Therefore, the yoyo model should be modified and some indispensable parts should be added to the yoyo model. Since lots of systems have been successfully explained by the original yoyo model, the modified yoyo model would be more efficient in applications. In the following, the modified yoyo model is proposed and it would be proved by some simple examples.

### *1.4 Organization of This Paper*

This paper focuses on the modified yoyo model and its application in Chinese history. In section 2, the modified yoyo model is introduced, including the background of the modified yoyo model, the characters of modified yoyo and their interaction. This section mainly consummates the yoyo model and makes the yoyo model have enough information to stand for the system exactly. The disciplines of the interaction between yoyos are helpful to predict the possible interaction result. Section 3 gives us a new example about modified yoyo model, which has not been illuminated by the yoyo model. Chinese history about Spring and Autumn and Warring States is a wonderful period, and the transition from slave society to feudalism society causes the complexity and the diversity of the politics, militancy and ideology. These can be all explained by the systemic yoyo theory, but only the military system is modeled by the modified yoyo model. The last section is the conclusions about the whole paper and two open problems about the yoyo model are introduced for the continuing research.

## 2 Modified Yoyos and Their Interaction

In order to give a more refined explanation about the system, the modified yoyo model and their interaction laws are proposed in this section.

### *2.1 Background of Modified Yoyo Model*

The key concept of System science is "system" and it has been a hot issue since its birth. Although it is still not clear enough, the basic properties, such as the wholeness, interaction and so on, has been accepted by lots of scholars. Now if we define a system, every one will understand what we mean. The yoyo model, a new tool as well as other system models, is proposed to describe the general system, and it has explained lots of properties of the system, such as the blown-ups and shrinking. It uncovers the essential characters of the general systems, i.e. the nonlinearity and unevenness cause the eddy motion. It is a great discovery that many unsettled problems in modern science have been solved by the yoyo model.

However, the yoyo model is not perfect, because another important factor, i.e. the behavior of the system, is not included in the model. Most of the time, we not only focus on the system itself, but also put emphasis on the interaction between systems. If a system can not have any influence on the environments, its existence will not make any sense. The system and its behavior should be

trussed together and modeled by yoyo model.

Except for the system itself, the behavior of the system is another aspect that can help us to understand the system's properties. For example, even if we never hear of or visit some company, we can know its size easily by its raw material or production scope. The raw material and production are considered as the input and output of the company, which can also be seen as the behavior of the company. When we research the company, the input and output are also important factors except for the company itself. Sometimes, we even can not capture the system; instead, we can only describe its behavior. Taking the black hole as an example again, nothing can escape from the black hole, including the light, let alone the scientists. So nobody can look into it, but we can conclude its properties by its behavior. Therefore, the behavior of the system supply us another way to describe the system.

On one hand, the basic characters of the yoyo depend on its behavior and can also be depicted by the behavior. For example, the stability, complexity and diversity of the yoyo can be reflected by its behavior. On the other hand, the interaction between yoyos is also based on their behavior. When a system receives an action from others or it has an action on others, the acceptation and the impartment are both the behavior of the system. For example, there is gravitation among three-body problem, and the competition exists between two similar companies. When a system has no behavior, it would not have any connection with the environments and then it would not make any sense for the development of the human, which would not be the research context of human. As to the close system, it actually would not exist in nature, i.e. the systems in nature are open and the close ones are ideal.

Therefore, the yoyo model should include not only the system but also their behavior, from which the basic characters and the interaction laws of the yoyos. In the following, the modified yoyo model and its new properties are proposed.

### *2.2 Modified Yoyo Model*

The basic concept of yoyo model has been introduced in detail, and every system can be considered as a yoyo model. In this subsection, the modified yoyo model is introduced, including its structure, intensity, polarities, size and its representation. All of them are reconsidered from a new point of view.

#### *2.2.1 Spin Field*

The yoyo model has been shown in Fig.1, where the eddy stands for the system, reflecting its nonlinearity and unevenness. What are the things that come into or out the yoyo from the black hole or the big bang? As to the company, they may be the input and output of the company; they can also be gravitation field for the celestial bodies; or they can be air current for the fan. They are actually the behavior ability of the system and can not be separated from the system, just as

Fig.2. The behavior of the system is also important for the interaction between systems, and they either receive the behavior from others or give off behavior to others. If a system does not have any behavior, maybe it would not exist any more. Therefore, the system and its behavior are trussed together and the yoyo model should also reflect both of them instead of the system alone. In the yoyo model, they are spin field through the yoyo, as along as the yoyo spins all the time. Without the spin field, the yoyo would not spin and the yoyo would be destroyed. What's more, the spin field is the medium that the yoyos connect

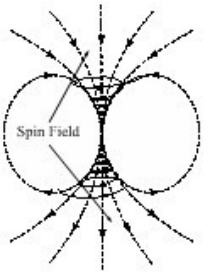


**Fig.2** Spin field of yoyo model

with each other. It is just like that the systems have connection with others by their behavior, instead of the system themselves. For example, the company changes its raw material and production as along with the outside market, and the output and input are medium for connection. Without these things, the company nearly has no behavior and no connection with the market. Therefore, the spin field is a necessary for the yoyo model; the yoyo will be destroyed without the spin field.

The spin field is not the part of the yoyo, i.e. the system, but it denotes all the behavior ability of the yoyo, including the action that the yoyo receives or gives off. Since the function of the system is carried out by its behavior, every system should have the behavior ability to realize some function; otherwise, the existence of the system would not make any sense. Therefore, as to the yoyo, there must be spin field through it, permeating the whole space.

*2.2.2 Spin Line*

In order to make the spin field exact and visible, the spin line (SL) is assumed to describe the spin field of the yoyo model and it does not exist actually. As to a company, each spin line stands for a flow of input or output. Generally speaking, a truss of spin lines of the yoyo reflects a kind of behavior ability by which the system has connection with other systems. All the spin lines of the yoyo form the whole behavior ability of the system, so the spin field is made up of all the spin lines of the yoyo, i.e. as to discretionarily given point in the spin field, there is a

spin line through it, shown in Fig.3. Since the spin lines denote the behavior

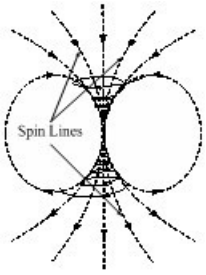


**Fig.3** Spin lines of yoyo model

ability of the system, the behavior intensity, i.e. the spin field intensity (SFI), should also be defined by the spin lines. The SFI at some point in the spin field is defined as:

$$SFI(p) = \lim_{a \to 0} \frac{1}{a} \int_{S(p)} SL(s)ds \tag{1}$$

where p is the observed point; SL(s) is the spin line that pass through the point s; the S(p), covering the observed point p, is the observed area and a denotes the acreage of the observed area, shown in Fig.4. Returning to the system archetype, SFI reflects the behavior intensity of the system, and where the SFI is larger, where the density of the spin lines is bigger, meaning that the system has a greater behavior.

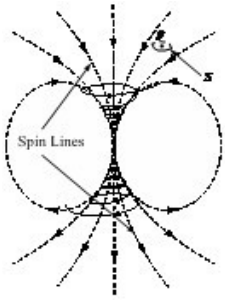


**Fig.4** Spin field intensity

There are two important properties of the spin lines, i.e. the partial occlusion and the non-intersection. Generally speaking, the partial occlusion means that some of the spin lines that depart from some points would return to these points after period of time and their tracks are just like some close loops, but others not. As to a system, the close spin lines denote that the action that this system takes to the environments has influence on the system itself actually. However, not

all the action from the system has influence on itself, so there also are non-close spin lines except for the close ones. For example, if a company is considered as a system, i.e. a yoyo model, the spin lines would be the flow of the input and output of the company. Some stuff of the input maybe just part of its production, which indicates some of the output returns to the company as part input of the company; and other output not. Therefore, the spin lines of the yoyo are classified as the close and the non-close, i.e. the spin lines are partial occlusion.

The second property of the spin lines is the non-intersection, i.e. each two spin lines in spin field of the yoyo do not have the same point. It means that the behavior of the system (a yoyo) would not have influence on its other behavior or each two categories of the behavior of a system are independent of each other. Actually it may be impossible that two categories of the behavior of a system do not have any connection with each other, but the puny connection is always ignored and they are supposed to be independent for a convenient analysis. This method of assumption has been used in nearly all the modern science, and it is also so in system science. Taking the three-body problem as an example, the popular method used in astrophysics is that the two heaviest bodies are firstly researched without the third body and then the third one is added to the two-body system. What to do next is just some modification of the system. The analysis results by the independent assumption are very close to the factual instance, although the modification is not discussed in this paper.

#### *2.2.3 Polarity of the Yoyo*

We have known that all the things come into the yoyo by the black bole and out from the yoyo by the big bang, so the black hole and the big bang are two basic properties or polarities of the yoyo. However, the black hole and the big bang do not have universality, and they are replaced by the polarity of the yoyo. In fact, each yoyo, i.e. each system, has two polarities, such as the input and output of the system. Generally speaking, each system has the ability of giving off influence on and receiving influence from the environments, and these different directions of behavior abilities of a system are considered as the system's polarities. Moreover, the two polarities of the yoyo can not be separated, such as the positive and negative polarities of a cell, the south and north poles of a magnet, etc. As to general system, if it only has influence on the environments and can not receive action, the system can not be controlled; if it only receives action from the environments and can not produce any action, the system would be useless and not exist any more.

Since two polarities of yoyo exist, they should be defined and their meanings should also be explained clearly. They are defined as the following. Every yoyo has two polarities, the positive and the negative polarities; the positive polarity is located in the side where the spin lines of the yoyo come out from the yoyo,

and the negative one is located in the other side of the yoyo, shown in Fig.6. The polarities can reflect the direction of the behavior of the yoyo, i.e. the yoyo takes action on others or receives action from others. For example, when a car is running by the control of the motorman, the motorman is located in the negative polarity and the running of the car is located in the other polarity. Both of the two polarities are important for the car, the car would make no sense without anyone.

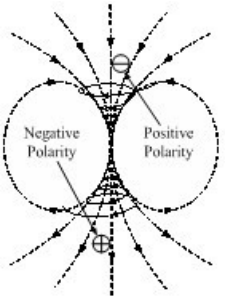


**Fig.5** Two polarities of the yoyo

*2.2.4 Size of the Yoyo*

When we focus on a yoyo (a system), its size is an important content. Actually it has great influence on the behavior intensity of the yoyo and even the behavior category, so it is discussed here. Generally speaking, the size is a relative concept and it is hard to define this concept among the systems belonging to different layers. In fact, the size of the yoyo depends on the research intention and content, and the size of even the same system would be different if it is researched by different intention and content. If two yoyos are researched for different contents, it would make no sense to compare the size of a yoyo with the other. For example, when we experiment on the mass of the earth and the velocity of the light respectively, the mass and the velocity can be seen as a measure of their sizes. However, they do not have any comparableness for the different dimensions.

As to the yoyos with the same research content, how shall we define the sizes of them by the yoyo model? When studying a yoyo, mostly we do not directly analyze the system itself; we can put an emphasis on its behavior instead. The definition of the size can also come from this thinking. If we study the mass of the earth, we can also measure it from the eart's gravitation to another known system, i.e. the outside behavior of the earth. And sometimes it is the only method to measure the yoyo's size, because the yoyo has not been mastered by the human in detail, such as the black hole, the universe, some particles and lots of social phenomenon.

In sub-subsection 2.2.1 and 2.2.2, we have defined the spin field and the spin

lines of the yoyo, and both of them depict the behavior of the yoyo. So it is natural to define the size of the yoyo by its spin field or spin lines. As to a given research content , the behavior of a yoyo is only some of all the spin lines except for studying any aspects of the yoyo, shown in Fig.5. In other words, the size of a yoyo is its behavior intensity at the research aspect.

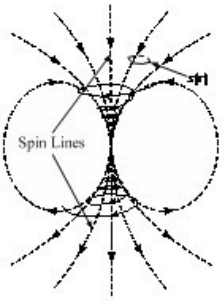


**Fig.6** Size of the yoyo for a given research content

Therefore, the size of a yoyo is defined as:

$$SIZE(\Gamma) = \int_{S(\Gamma)} SL(s)ds \tag{2}$$

where $\Gamma$ is the research content and $S(\Gamma)$ is the total spin lines that stands for the whole behavior at the aspect $\Gamma$. If the spin lines denote the input or output flow of a company, then the total input or the output, defined as the size of the yoyo, can reflect the manufacture size of the company sufficiently.

*2.2.5 Denotation Symbol of the Yoyo*

In the book "systemic yoyos" written by Professor Lin, the denotation symbol of the yoyo model has been given in detail, just like Figure 7. They are very visual, but there is some discommodiousness by these symbols. First of all, they can not contain enough information of the yoyo, such as the spin field, the size and the polarity of the yoyo, so they can not denote yoyos sufficiently. Secondly, these symbols are inconvenient to paint on the papers, because there is a long line round some fixed point and it is hard to paint roundly. Moreover, they take up a larger area of the paper. Thirdly, when two yoyos have interaction with each other, their shapes change to elliptic type. If these symbols denoted the yoyos, does that mean the yoyos themselves have been changed? As we known, the interaction between yoyos need not change the yoyos, but we can not see the interaction clearly if the shape does not change. Then a contradiction occurs. Fourthly, as to a given yoyo model, we can see different spin directions from different sides, so how shall we make a decision about the spin direction when painting them?

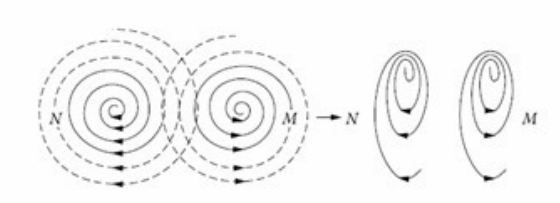


**Fig.7** Denotation symbol of the yoyo given by professor Lin

Therefore, a simple and convenient symbol is given in Fig.8. This symbol is a line with the same direction to the spin lines of the yoyo; its length is decided by the size of the yoyo; the line points from the negative polarity to the positive polarity and the jumping-off point of the line is located in the neck of the yoyo. Moreover, when a yoyo line is given, the spin yoyo can be only ascertained by the representation laws. The representation law can be described as the following: the direction of the spin lines of the yoyo is accordant to that of the symbol, and spin direction of the yoyo has dextro rotation relation with that of the symbol, i.e. when the yoyo line is grasped by the right hand and the thumb points to the direction of the spin lines, the spin direction of the yoyo is along to the direction of other four fingers; the size of the yoyo is also ascertained by the length of the line. This representation symbol is not only simple but also contains nearly all the information of the yoyo. What's more, they have interaction with each other by the spin field, i.e. their behavior, instead of the yoyos.

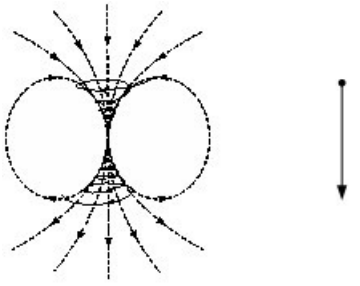

**Fig.8** Yoyo model and its denotation symbol

*2.3 Properties of Modified Yoyo Model*

Since the yoyo model has been modified and some dimensions have been added to the yoyo model, the new properties of the yoyo model are discovered naturally. These include the characters of the yoyo and the interaction between yoyos, which are described lively by the new dimensions.

*2.3.1 Basic Characters of the Modified Yoyo*

As to the simplex yoyo, the most interesting things are how the yoyo comes to being and perdition, how the yoyo keeps steady and why the yoyo can endure the little change of the outside environments. All the answers come from the modified yoyo model and they can be explained in the following by the form of properties.

**Property1** : The cause and effect relation leads to the continuity of the spin line through the yoyo, so the fluxes through two polarities are equivalent.

The cause and effect relation widely exists in the world. For example, we are living for food; the output is produced for hard work; and the circle movement of celestial bodies keeps for their gravitation. So the cause and effect relation is general in the word, including the modified yoyo model. Every effect of a system is begotten by some cause that has been known completely or incompletely. Maybe there is more than one reason that leads to a selfsame result; to analyze these complex reasons conveniently, all of them are summed up to a spin line that links to the spin line of the result at the neck of the yoyo. Therefore, the spin lines that have been painted in the figures continuously pass through the yoyo, which indicates the cause and effect relation of the system.

Since every cause spin line leads to an effect spin line and every effect spin line is begotten by a cause spin line, it is concluded that the quantities of spin lines through each polarity, i.e. the two fluxes of spin lines through two polarities correspondingly, are equivalent. When the "cause" spin lines change, the "effect" spin lines would change correspondingly. For example, if a factory is modeled as a yoyo, the change of the producers' goods must leads to a change of the yield.

The equivalence of the spin lines through two polarities can bring the convenience for analyzing the characters and interaction of the yoyos, so it is a basic and important property. For example, according to the research content and intuition, the size of the yoyo can be defined by each flux of spin lines through two polarities. Another example is that the direction of the spin lines can be ascertained by each polarity of the yoyo for their equivalence.

**Property2** : The behavior size of a yoyo has equipollence with its TSME size.

The size of a yoyo is defined by its behavior ability, i.e. its spin field, and this definition is one of many possible definitions about the yoyo's size. It can be used to describe the size of a yoyo if the yoyo's structure and component are not learned clearly by us or we pay our attentions to the yoyo's behavior ability instead of itself. When a yoyo has some invariability with regard to its structure or component, maybe it also can be used to describe the yoyo's size.

Because for each given yoyo there must be a positive number such that:

$$AT \times BS \times CM \times DE = a \tag{3}$$

where A,B,C,D and D are some constants determined by the structure and attributes of the system of our concern,T is the time as measured in the system,S is the space occupied by the system, and M and E are the total mass and energy contained in the system. If the yoyo keeps steady, the positive constant a, called TSME size in this paper, measures the essential size of the yoyo. Moreover, the behavior size has some equivalence with the TSME size, i.e.:

$$a \Leftrightarrow \sum_{\Gamma \in \Omega} SIZE(\Gamma) \tag{4}$$

where $\Gamma$ is a sort of behavior ability, and $\Omega$ is the set of all behavior abilities.

**Property3** : The diversity and complexity of a yoyo are reflected by that of its behavior abilities, i.e. the spin field.

Now we have known that the world is wonderful for all kinds of species, so why the world is composed of so many objects, including the organics and the inorganics? The great natural historian Darwin gives the answer by his Darwinism, stating that all species of organisms arise and develop through the natural selection of small, inherited variations that increase the individuals ability to compete, survive, and reproduce. In other words, the national selection of behavior abilities causes the biology evolution as well as the inorganics.

Another visible example is that lots of artificial objects, such as the car, the computer, the airplane and so on, arise as the development of the human civilization, which increases the diversity and complexity of the world. Their appearance lies in that their various behavior abilities can service for the human. We can not affirmatively conclude that the diversity and complexity of the system are brought to by their various behavior abilities, but it is affirmative that the diversity and complexity of the system can be reflected by that of its various behavior abilities.

As to the yoyo model, its structure, component and attributes are not discussed in detail, so it is hard to talk about its diversity and complexity by the yoyo itself; however, its spin field, i.e. the various behavior abilities, can reflect its diversity and complexity. So the different behavior abilities and intensities stand for the difference between different yoyos.

**Property4** : The stability of the yoyo is equivalent to that of its spin field.

Firstly, let us discuss the stability of the system. When a system is in the state of stability, its component, structure and function all do not change as time going by. Of course its behavior is also steady. If the system's component or structure changes, its behavior would change correspondingly, which even can not be discovered easily by us. Moreover, if the behavior of a system keeps steady, the system must also keep steady. In other words, the behavior of a system can reflect the stability of the system.

For example, when a cup is broken up, it can not be used for drinking, i.e. the

behavior of the cup has changed greatly. Sometimes the destruction of a system can not bring a timely change of its behavior, but this change would come sooner or later. Taking the assumptive vanishing of the sun as an example, all the planets in solar system maybe can not experience this change at once, i.e. they can still receive the gravitation and light for about 8 minutes[8], but their orbits must change for the disappearance of the sun finally. The change of the behavior of a system must lie in the change of the system; otherwise, we even can not control the simplest system to service for the human.

In modified yoyo model, the system and its behavior are modeled as the yoyo and its spin field, so the stability of the yoyo is equivalent to that of its spin field.
**Property5** : The change of the spin field leads to the corresponding size change of the yoyo.

The change of the spin field means that the behavior of the yoyo has changed, so the size of the yoyo changes for its definition. When an additional "force" is operated on a system and its function is changed, the behavior of the yoyo must be changed correspondingly. For example, the input and output of a company, i.e. the spin field of a yoyo, are reduced for the furious market competition, and then the company has to reduce its size, such as reducing the employees, decreasing the salary and saving the cost. Otherwise, the company would take the opposite action.
**Property6** : The yoyo has inertia to keep the original state.

The concept of inertia, explicitly proposed by great physical scientist Newton, is used to describe the kinetic character of all the objects. The inertia counterworks the change of the movement of an object, but it can not stop this change. Does a system (yoyo) have similar inertia to counterwork the change of its state or stability? Yes, it not only can counterwork this change but also can stop this change within some range, i.e. when the yoyo is influenced by some outside factors, the yoyo, including its structure and its component, would not change if the influence is limited in some extent. The influence that begins to make the yoyo change is defined as the stability boundary.

As to a relationship between two persons, denoted by A and B, when one of them, supposed as A, satirizes the other person for some reason, B would accept the advance and their relationship holds out in all probability if B is given enough prestige; however, if A speaks ill of the person B now and then instead of proposing his advance by courtesy, his action would go beyond the stability boundary of their relationship and the relationship would break up. Therefore, the relationship system has the inertia to keep the original state.

The inertia is important for the stability of the yoyo; otherwise, the yoyo would be changed as long as it is affected by the environment, no matter how little the effect is. The influence boundary describes the stability degree, and the yoyo is

steadier if its influence boundary is larger. The inertia helps the yoyo to have a steady spin field, i.e. the yoyo has a steady behavior, and then the yoyo has a steady function to servicing for the human.

**Property7** : The yoyo comes into being or perdition both for the poignant change of the spin field of the environment, i.e. all the systems outside the observed system.

The development of the yoyo is important for the system research and it also reflects the phenomenon of everything's movement. The development of a yoyo means the processing of the yoyo from an old state to a new state, and these change including the variety of the components, structure or attributes of the yoyo. In other words, the development of a yoyo can also be considered as the perdition of the "old" yoyo and the being of a "new" yoyo. Therefore, if the perdition and the being of a yoyo are researched clearly, the development of the yoyo is also known by us. How does the yoyo come into the being or perdition? Property 7 gives us the answer.

When the spin field that the observed yoyo is located in changes greatly, the yoyo would receive great "force" from the spin field and it would be destroyed if the "force" exceeds the stability boundary of the yoyo. When two or more yoyos have interactions with each others, their composed spin field would greatly change, and the new yoyo would come into being among their poignant interaction. For example, In the Chinese history of the Spring and Autumn and Warring States, the country Jin was overthrown under the condition of unstable political, economic and cultural positions, which had exceeded the stability boundary of the country Jin, and three new countries came into being from the "old" country Jin.

There are two basic processing by which the old yoyo is destroyed and the new yoyo comes into being. One of them is the composition, i.e. two or more yoyos form a new yoyo, such as the composition of two companies; the other is the decomposition of an old yoyo into small new yoyos, such as the dividing of a country. In a word, the yoyo's being or perdition lies in the poignant change of the spin field.

### *2.3.2 Interaction Between Modified Yoyos*

The modified yoyo model and its some basic properties have been introduced, and then the interaction between modified yoyos is studied, because all the objects in the world have connections with each other generally and they lead to all the change instead of the isolated system. Moreover, the birth of new yoyo and the perdition of the old yoyo both are created by the interaction between yoyos. The clear knowledge of the interaction between yoyos is helpful for us to grasp the properties of the yoyo.

**Property8** : The interaction between the yoyos depends on the spin field.

As is argued above, the spin field of the modified yoyo is used to describe the behavior of the yoyo and SFI scales the behavior intensity. When yoyo A is in the spin field of yoyo B, A would receive the action from B. For example, the competition between two companies means that their productions scrabble for the market, i.e. their spin fields fight with each other instead of the companies. Another example is about the sun and the earth, both of which are considered as two systems. Their spin fields, i.e. their gravitation fields, are the medium that they attract each other.

**Property9** : The locations and the polarity directions of spin field where a yoyo is located determine the influence that the yoyo receives.

The interaction between the yoyos depends on their spin field, and this thesis tells how a yoyo receives the influence by the spin field of another yoyo. As to the same two yoyos, if they have little connection with each other, their behavior on each other would have small intensity. As we known, where the behavior intensity is smaller, where the density of spin lines is smaller and the distance between two yoyos is larger, vice versa. Because the polarity of the spin lines stands for the direction of the behavior ability, the direction of a yoyo is determined by its behavior. If two yoyos have the same behavior abilities, they have the same directions, i.e. the polarities, vice versa. If some of their behavior abilities are the same, some are opposite and the other are different, their polarities would have a angle that ranges from zero to $\pi$.

For example, the workers work in the factory and the farmers work on the farm, so their behavior abilities, i.e. their work skills, nearly are different from each other. They are assumed to be vertical to each other, shown in Fig.9. In fact, there also are farkers in our country in recent years, who work on the farm when the harvest is coming and in the factory without harvest, so its yoyo is located between the worker yoyo and the farmer yoyo. Since the size of farkers, i.e. the product of their quantity and their working load, is less than that of the workers and that of the farmers, the length of the farker yoyo is less correspondingly.

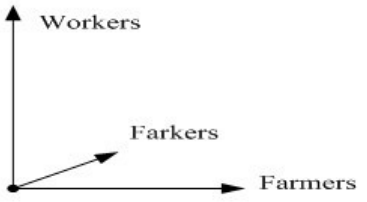


**Fig.9** The polarities of different yoyos

**Property10** : Superposition law

If there are only two yoyos, they would be in the spin field of each other, which

is simple to analyze. When a yoyo is in the spin field of two or more yoyos at the same time or two or more yoyos are considered as a whole, how shall we seek the spin field of the whole from the yoyos? Superposition theorem would tell us the answer.

Superposition law tells that the spin field of the whole yoyos is equivalent to the superposition of the spin field of each yoyo. The law means that the spin field of yoyos is independent with that of each others. Please note that this law does not mean that the spin field of the yoyos does not have interaction with each other; instead the whole spin field is composed of each independent spin field of the yoyos. For example, the earth is in the gravitation field of the sun and the moon, and the gravitation of them independently effects on the earth; the whole gravitation felt by the earth is composed of the gravitation of the sun and the moon together, and the composition method of the spin lines is introduced by the spin line composition law in the following.

**Property11** : Spin line composition law

The whole spin field is achieved as long as its spin lines are gotten. Suppose that there are two yoyos in the field space, such as yoyo A and yoyo B in Fig.10. At a randomly given point p in the field space, the spin lines of yoyo A and yoyo B are a and b with regard to and respectively. By vector composition laws, the whole spin line c at point p is composed by vectors a and b, shown in Fig.10.

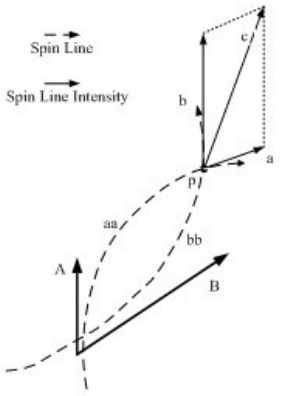


**Fig.10** Composition of spin field

The spin line composition law reflects the nonlinearity of the interaction of the yoyos, i.e. the systems. The whole behavior of two yoyos is not the simple linear sum of each, and the direction and the intensity of the whole behavior has parallelogram relation with the original spin field. Now another problem that seems hard to solve is the phenomenon "$1 + 1 > 2$", i.e. the whole behavior

seems stronger than the sum of each individuals. In fact, there has been another new yoyo produced by the poignant interaction of the yoyos.

**Property12** : Yoyo composition law

In fact, the yoyo composition law can be concluded by the superposition theorem and spin field composition law. However, the yoyo composition law uncovers the discipline of the composition of yoyos from a high level and it let us see the processing of new yoyo's birth clearly. The law can be used to explain the combination of the factories, the combined armies, etc.

The yoyo composition law tells that the composition of yoyos satisfies the vector composition law, shown in Fig.11. Yoyo A and B from the new yoyo C, and their spin field are piled in the field space; the spin field of the new yoyo C is gotten by the spin field composition law, and then we get the new yoyo C. The yoyo C also has parallelogram relation with the original yoyos.

Because the composition of yoyos does not simply sum the yoyos linearly, this composition reflects the nonlinear relation between yoyos. Therefore, this law can be fit to the complexity of the systems.

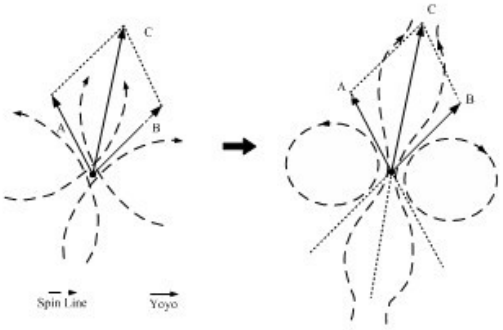


**Fig.11** Composition of yoyos

## 3 Modified Yoyos of Chinese History

Spring and Autumn and Warring States Periods, from 770 BC to 221 BC, is in the interim from ancient civilization to middle ages civilization and is also a transformation with sharp social movements, complex political dispute, endless warfare and wonderful academic culture. Spring and Autumn began with the East-transfer of the king Ping, and then the Western Zhou Dynasty became weaker and weaker. Because the vassals contended for the slavery and the strong country oppressed the weak, many wars began to act on the historical arena. The partition of the country Jin by three vassals indicated the end of Spring and Autumn and the beginning of Warring States. During this period, except for the appearance of reformation, the wars between countries were more and more for

more ground and wealth. In 238 BC, The first emperor of Qin began to prepare for overthrowing other six countries; finally he established the first centralized multinational country in Chinese history with the perdition of Qi in 221 BC. The Chinese history came into a new era.

During the period of Spring and Autumn and Warring States Periods, there was a homology between different countries, because they were all located at the era from slave society to feudalism society. One of them was the wars that happened between numerous countries. During the 242 years of Spring and Autumn, there had been more than 170 vassal countries recorded in history; 36 vassals were killed ferociously; 52 vassal countries were overthrown by more than 480 wars, and the vassal meetings were more than 450. The wars became more and more and the size of wars were much larger than that in Spring and Autumn as the history came into Warring States. In the ancient slave society with the underdeveloped science and technology, the number of the soldiers is an important factor for the war, so the total belligerent soldiers of both countries maybe reached tens of thousands even hundreds of thousands. Therefore, the history of Spring and Autumn and Warring States Periods also can be called a martial history.

In this section, both sides of the war are considered and modeled by the modified yoyo model as well as their interaction correspondingly. Since these matters occurred more than two thousands years ago, there were more word depictions instead of integrated and detailed record data. However, the Chinese history is modeled by the modified yoyo model to the best of our abilities.

### *3.1 Military Yoyos*

Every new overlord was established with bleedings and sacrifice by the wars. During the period of Spring and Autumn and Warring States, there were so many wars that lots of famous generals and specific example of a battle, such as the Battle of Zhongyuan, the Battle of Handan and the Battle of Changping, had been studied by scholars. How shall we predict the result of a war by the war factors? The yoyo model supplies a useful tool to study the war and the interactions between the both sides of the war can help us to know the result.

Generally speaking, there are many factors that commonly decide the result of the war and these factors can be changed at different periods. Economy of a country is a key factor that has influence on its munitions, such as the food supplies and armament, that service for the army; moreover, in the ancient time, the country population is also decided by the economy. The science and technology, deciding the power of the weapon, are universal underdeveloped, so the weapons of different countries during Spring and Autumn and Warring States are almost the same. Although the daily training had been formed at that time, the abilities of a single soldier of different countries are also nearly the same. The morale of the soldiers is important for the war, and it is decided by the prompting actions

of the generals. Heroical historical view pays great attentions on the heroes or the generals of a war, so they are considered as a factor of the war. According to the records in history[9], the situations of the war were always turned by the wisdom of the generals.

Now the military organization of a country in Spring and Autumn and Warring States is modeled by the yoyo model. According to the analysis above, the number of soldiers and the wisdom of generals are the most important factors that decide the result of the war; and other factors are ignored for their similarities between different countries. Assume that the population of the country is N and the number of its soldiers is $N_1$, where $N_1 \leq N$. Therefore, the number of the people that are arranged to work for the economy is $N_2$, where

$$N_1 + N_2 = N \tag{5}$$

Generally speaking, $N_2$ affects the battle effectiveness indirectly by affecting the economy of the country, because the food, the clothes and the weapons of the soldiers come from the economy contributed to by its people. So the change rate of the battle effectiveness P can be expressed as:

$$\frac{dP}{dN_1} = aN_1N_2 \tag{6}$$

where $\alpha$ is a constant, which means that the battle effectiveness will increase with the growth of the numbers of the soldiers and the workers. Please note that Equ.(6) is only fit for the ancient wars instead of modern wars, because the former is much simpler than the latter. Combining Equ.(5) and Equ.(6), we have:

$$\frac{dP}{dN_1} = aN_1(N - N_1) \tag{7}$$

As we known, the army is used to protect its country and overcome other countries. So an important rule of the war is that the battle effectiveness aspired after by the Sovran of the country is to overcome other countries and protect the security of its country instead of maximization of the power. Therefore, the number of the soldiers is also affected by its battle effectiveness, i.e. when the battle effectiveness is strong, the number of the soldiers would decrease, vice versa. So we have:

$$N_1 = \gamma(P_0 - \beta P) \tag{8}$$

where $P_0 > 0$, which avoids the appearance of negative battle effectiveness; and $\gamma > 0$, $\beta > 0$, which means that the country would decrease its soldiers if its battle effectiveness has became strong enough. Taking Equ.(7) into Equ.(8), we have:

$$\frac{dP}{dN_1} = AP^2 + BP + C \tag{9}$$

where $A = -\alpha\gamma^2\beta^2 < 0$, $B = 2\alpha\gamma^2 P_0\beta - \alpha N\gamma\beta$ and $C = \alpha\gamma N P_0 - \alpha\gamma^2 P_0^2$.

The wisdom of generals is always a key factor. If one side of the war does not have enough stratagems, it sometimes would be defeated by the other side with a relative weak power. The battle effectiveness should be affected by a factor $k \in [0, 1]$ about the wisdom of the generals. When the generals have great providence, stratagems and brightness, such as Lianpo, Limu and Sunwu, the factor k=1; if the general is an armchair strategist, such as Zhaokuo, the factor k=0; otherwise, the factor $k \in (0, 1]$). Therefore, Equ.(9) can be rewritten as:

$$\frac{dP}{dN_1} = k(AP^2 + BP + C) \tag{10}$$

How does the battle effectiveness keep steady between all the countries? When the battle effectiveness is balanceable, the possibility of wars is small, vice versa. So the stability is the focus that most of the scholars pay attentions to. The discriminant of Equ.(9) is:

$$\Delta = B^2 - 4AC \tag{11}$$

So there are three cases: $\Delta = 0$, $\Delta > 0$ and $\Delta < 0$. The evolution models are also different at different cases. In the following, let us take the first case as an example.

If $\Delta = 0$, there is only one balance, i.e. $P_1 = -2A/B$, that all the countries do not invade each others. So we have:

$$P(N_1) = k\Big(P_1 - \frac{1}{P_2 + AN_1}\Big) \tag{12}$$

where $P_2$ is the initial constant determined by the country condition. If $P_2 < 0$, so $N_0 = -P_2/A < 0$. The battle effectiveness decreases with the increasing of the soldier number. When $P_2 > 0$, $N_0 = -P_2/A > 0$. If C, the larger the soldier number, the stronger battle effectiveness. If $N_1 = N_0$, the discontinuity occurs to the battle effectiveness. If $N_1 > N_0$, the battle effectiveness would decrease as the soldier number's rising. This processing indicates that the battle effectiveness could not blindly increase as the soldier number. By the restriction of economy of the country, the army would keep a balance or fluctuate at some size.

Now let us analyze the representation of the yoyo model of the military organization. The spin field, depicted by the spin lines, naturally denotes the behavior ability, i.e. the battle effectiveness and the resistance. The spin field is important for the yoyo to have connection with others, because the behavior abilities of a yoyo is given off or received by its spin field, just like invading other countries. Except for the soldiers and the generals, there should be other factors that affect the military organization, such as the weapons, logistics and geography. When modeling the yoyo, they are all ignored for the puny differences between them.

This disposal is consistent with the known word records, because most of the wars recorded in history only come down to the soldiers, generals and the stratagems[10].

What's more, the stronger the behavior ability is, the larger its spin field is, which leads to a larger size of the yoyo. When interacting with other yoyos, the yoyo with larger size would be the leading role. For example, the victory of the country Zhao in The War of Fei[9], with the leader of general Limu, showed that the country Zhao had stronger behavior ability than the country Qin for the wonderful stratagem. The polarities of the yoyo reflect the directions of the behavior ability, i.e. the military organization gives off its action or receives the force from others. If two countries had the same battle goal and defeated their common enemy, their yoyos would have the same polarities.

According to the definition of the size of the yoyo, the size of a yoyo means the battle effectiveness; in fact, it also can be measured by its munitions, i.e. its food supplies and armament, although this measurement is inconvenient in this paper. Therefore, the yoyo of a military organization can be expressed in Fig.12.

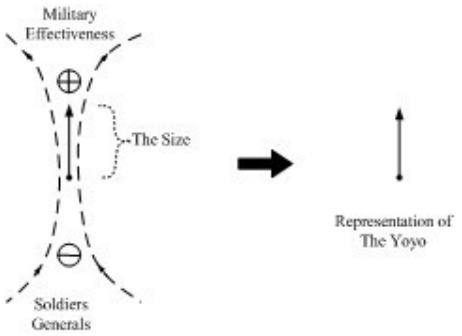


**Fig.12** The yoyo of military organization

*3.2 Explanations of the Yoyo's Characters*

The explanations of the yoyo's characters are considered by the qualitative analysis, such as the figurative analysis method, of the historical events in Spring and Autumn and Warring States.

That the soldiers and the generals determine the military effectiveness means that the spin lines at different polarities have a corresponding relation. Taking the country Wu and Chu as examples, when the king Helv of Wu paid great attentions to the development of the army and selected the militarist Sunwu as general, the military effectiveness of Wu became larger and larger and defeated the Chu finally[10]. So we can conclude that the investment and the harvest, i.e. the received behavior and the external behavior, are equivalent.

Moreover, the stability of the military effectiveness is equivalent to that of the

yoyo, i.e. only if the military organization has a steady military effectiveness, the organization would be also steady, and vice versa. When the military organization was not defeated by others, its military effectiveness was not changed, i.e. it was steady. It was sure that the organization was still steady by the protection of the steady military effectiveness. If the military effectiveness of a organization was decreased by other organizations, the military effectiveness would be unsteady and so was the military organization. The country Qi was nearly conquered thoroughly in The War of Yan and Qi, because its military effectiveness was extremely unsteady, only 7000 persons left after that war[10].

The change of the effectiveness would lead to the change of the size of the yoyo. When we select the military organization as the yoyo model, its behavior ability will be the research context and intuition. Therefore, the military effectiveness is used to describe the size of the yoyo exactly. It seems that the number of the soldiers and the generals is fit to measure the yoyo's size, but it can not capture the essentials of military organization.

As to a given military organization, it has inertia to keep steady and it would be steady if the outside force acted on the yoyo does not exceed the stability boundary. It is well explained by the phenomenon that not all the wars lead to perdition of the military organization. For example, during The War of Yan and Qi, the country Qi did not be conquered finally although there were only 7000 persons left; this means that the violent military shock of Yan still did not exceed the boundary of Qi's perdition. On the other hand, this boundary of a yoyo can reflect the inertia of the stability of the yoyo, returning the example above, the Qi had great attributes to keep its country, i.e. the structure and component of the yoyo.

The furious change of the spin field, exceeding the inertia boundary, would lead to the birth of a new yoyo and the perdition of an old one. For example, The War of Wu and Yue had been lasting for more than 30 years[10]; it showed that when the change of the spin field could not exceed the inertia boundary, the yoyo, i.e. the country, could not be changed. Finally the perdition of the country Wu shows that the force acted on it by the country Yue had exceeded its inertia boundary and the yoyo came to perdition. At the same time, the country Yue became a new yoyo with the addition of Wu's land and wealths.

### *3.3 The Interaction of the Yoyos*

What about the interactions between different countries? The combination of countries reached the climax at the end period of Warring States, such as the combination of six countries for resisting Qin[9]. Let us analyze this phenomenon by the yoyo model. The combination of six countries means that the six yoyos with different sizes are united together; by the composition laws of the yoyos, the new yoyo of the combination should be stronger than that of the Qin, shown in

Fig.13, why would the Qin be the winner finally?

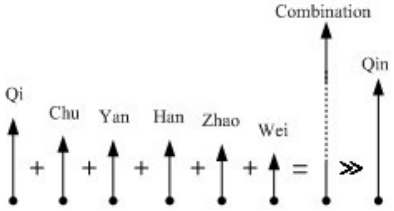


**Fig.13** The perfect combination of six countries and Qin

The problem lies in the polarities of the six countries, and the Fig.13 shows that the polarities of the six countries are the same. However, in history the six countries had never been actually united together, and they acted by the motivation of their own benefits instead of defeating their enemy Qin. Therefore, the polarities of the six yoyos were not consentaneous, shown in Fig.14, and their combination was still weaker than the Qin. Moreover, the country Qin tried itself to destroy the combination of the six countries by alienating these countries one by one, so there even were some countries that attacked their allies surreptitiously, such as the country Wei. When the number surviving countries was fewer and fewer, they could not defeat the strongest country Qin even if they shared a bitter hatred of the enemy Qin for their puniness finally. In 221 BC, the country Qin defeated the six countries and established a centralized multinational country in Chinese history, i.e. a new yoyo appeared by their complicated interactions.

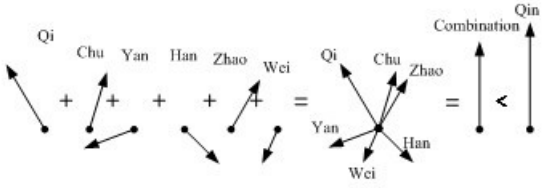


**Fig.14** The factual combination of six countries and Qin

## 4 Conclusions

This paper focuses on modifying the yoyo model and proposes the modified yoyo model. Firstly, the modified yoyo model enriches the yoyo model. The concept of the spin field is endowed with new meanings, i.e. the behavior abilities of the yoyo, and the spin lines are used to depict the spin field exactly, including the intensity and polarity of the spin field and the size of the yoyo. The symbol denotation of the modified yoyo is convenient to describe the yoyos and their

interaction. The modified yoyo model has more basic concepts about the system. Secondly, the characters of the modified yoyo are researched in detail. The stability, diversity and complexity of the system can be reflected by the modified yoyo model; the equipollence of the stability between the yoyo and its spin field, the spin line between two different polarities and the yoyo's size between the behavior and the TSME is also discussed; finally, the perdition and the birth of yoyo are explained by the inertia of the stability effectively. At last, the interaction between yoyos is studied and the composition laws of the spin lines and the yoyos are proposed. In order to prove the practical usefulness of the modified yoyo model, the Chinese history of Spring and Autumn and Warring States, mainly about the military affairs, is explained by this model. According to the analysis results, the military organization of each country can be considered as a yoyo, and the basic characters of the yoyos and their interaction can be reflected by the word records in history. Therefore, the modified yoyo model has the rationality, to some degree, as the complementarities of the yoyo model.

The modified yoyo model has referred to many basic properties of the system, but these are only restricted to the word description, i.e. qualitative analysis, or the figurative analysis method instead of the quantitative analysis, which should be an open problem for the development of the yoyo model. Another open problem is that since almost any objects can be seen as systems, how these systems are modeled by the yoyo model exactly and effectively.

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